

## CLAIMS

1. A semiconductor optical waveguiding device comprising:
  - a first cladding layer;
  - 5 a second cladding layer; and
  - a waveguiding layer disposed between the first and second cladding layers and having a substantially higher refractive index than said first and second cladding layers;

wherein at least one of the first and second cladding layers includes a beam control layer in which a property of the semiconductor material varies as a function of depth through the layer, the beam control layer including a first sub-layer in which the property varies gradually from a first level to a second level, and a second sub-layer in which the property varies gradually from said second level to a third level.
- 15 2. The device of claim 1 in which the third level is substantially equal to the first level.
3. The device of claim 1 or claim 2 in which the property that varies is 20 the composition ratio of the material.
4. The device of any preceding claim in which the first sub-layer provides a gradually decreasing conduction band edge, and the second sub-layer provides a gradually increasing conduction band edge.
- 25 5. The device of any preceding claim in which the first sub-layer provides a gradually increasing refractive index and the second sub-layer provides a gradually decreasing refractive index.

6. The device of any preceding claim in which the first and second sub-layers are contiguous.
7. The device of any preceding claim in which the first level is substantially equal to the level of the property in the adjacent cladding layer.  
5
8. The device of any preceding claim in which the third level is substantially equal to the level of the property in the adjacent cladding layer.
- 10 9. The device of any preceding claim in which the property of the first sub-layer varies between the first level and the second level in a substantially linear manner.
10. The device of any preceding claim in which the property of the second sub-layer varies between the second level and the third level in a substantially linear manner.  
15
11. The device of any preceding claim in which the first and second cladding layers are formed from a GaAs-based or InP-based system.  
20
12. The device of any preceding claim in which the waveguiding layer is a quantum well layer.
13. The device of any preceding claim further comprising a substrate, the first cladding layer being a layer most proximal to the substrate, the mode control layer being provided within the first cladding layer.  
25
14. The device of claim 13 in which the substrate comprises GaAs, the first cladding layer and beam control layer comprises n-type AlGaAs, and the second cladding layer comprises p-doped AlGaAs.  
30

15. The device of any preceding claim including a ridge waveguide.

16. The device of any preceding claim in which the property is refractive index, and in which the refractive index is gradually varied in the first and second beam control sub-layers by gradually varying thicknesses of alternating sub-layers of different refractive index, each alternating sub-layer having a thickness substantially less than a wavelength of light.

10 17. The device of claim 12 comprising any one or more of a laser, an optical modulator or an optical amplifier.

18. A method of forming a semiconductor optical waveguiding device comprising the steps of:

15 forming a first cladding layer on a substrate;

forming a waveguiding layer on said first cladding layer, the waveguiding layer having a refractive index substantially greater than the first cladding layer;

20 forming a second cladding layer on said waveguiding layer, the second cladding layer having a refractive index substantially less than the waveguiding layer; and

25 during the step of forming said first cladding layer, forming a beam control layer therein by gradually modifying deposition conditions so as to vary a property of the semiconductor material as a function of depth through the beam control layer, such that the beam control layer includes a first sub-layer in which the property varies gradually from a first level to a second level, and a second sub-layer in which the property varies gradually from said second level to a third level.